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Mourning Dove

Breeding Population Status, 1993

U.S. Fish & Wildlife Service

Department of the Interior

MOURNING DOVE BREEDING POPULATION STATUS, 1993

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Abstract: This report includes Mourning Dove Call-Count Survey information gathered over the last 28 years. Trends were calculated for the most recent 2 and 10-year intervals and for the entire 28-year period. Between 1992 and 1993, the average number of doves heard per route declined significantly in the Central Management Unit, but did not change significantly in the Eastern and Western Units. No significant trend was found in doves heard in the Eastern or Central Units for either the 10 or 28-year time frames. In the Western Unit, no trend was evident over the most recent 10 years, but there has been a significant decline over 28 years. Trends for doves seen at the unit level over the 10 and 28-year periods generally agreed with doves heard.

The mourning dove (*Zenaida macroura*) is a migratory bird, thus, authority and responsibility for its management is vested in the Secretary of the Interior. This responsibility is conferred by the Migratory Bird Treaty Act of 1918 which, as amended, implements migratory bird treaties between the United States and other countries. Mourning doves are included in the treaties with Great Britain (for Canada) and Mexico. These treaties recognize sport hunting as a legitimate use of a renewable migratory bird resource. Sadler (1993) stated that the mourning dove provides over 10 million days of hunting recreation annually. He also estimated that in 1989 (the most recent estimate available), about 2.3 million persons harvested about 41.3 million doves. As one of the most abundant species in both urban and rural areas of North America, it is familiar to millions of people who enjoy its presence each day. Maintenance of mourning dove populations in a healthy, productive state is a primary management goal. To this end, management of doves includes assessment of population status, regulation of harvest, and habitat management. Call-count surveys are conducted annually in the 48 conterminous states by state and federal biologists to monitor mourning dove populations and aid wildlife administrators in setting annual hunting regulations.

Distribution and Abundance

The breeding range of the mourning dove includes the 48 conterminous states, the southern portions of the Canadian Provinces, the Greater Antilles, and Mexico (Fig. 1). Two subspecies occur within the United States (Aldrich 1993). *Z. m. marginella* is found in the western two-thirds of the nation, while *Z. m. carolinensis* occupies the eastern portion. A zone of overlap contains an intermediate form of the 2 races.

The mourning dove is one of the most widely distributed and abundant birds in North America (Robbins et al. 1986, Fig. 1). Although not known precisely, the fall population has been estimated to be about 475 million (Dunks et al. 1982, Tomlinson et al. 1988).

Population Monitoring

The Mourning Dove Call-Count Survey was developed to provide an annual index to population size. This survey is based on work by McClure (1939) in Iowa. Field studies demonstrated the feasibility of the survey as a method for detecting annual changes in mourning dove breeding

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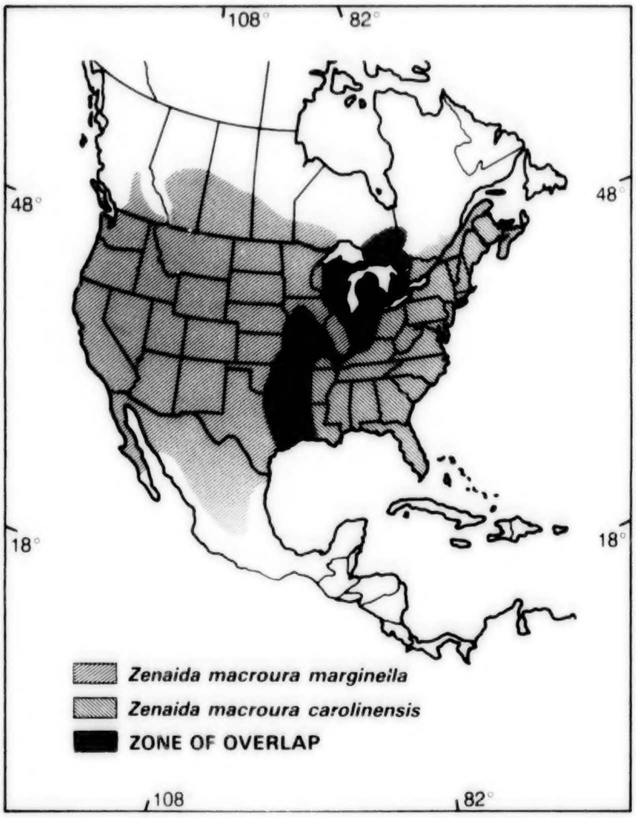
The primary purpose of this report is to facilitate the prompt distribution of timely information. Results are preliminary and may change in the final analysis with the inclusion of additional data.

Artist David Maass and Wild Wings, Inc., Lake City, Minnesota, provided the cover art for this report.


108°
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▨ Zenaida macroura marginella
▨ Zenaida macroura carolinensis
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Fig. 1. Breeding range of the mourning dove (Aldrich 1993).

populations (Foote and Peters 1952). The first nationwide survey was conducted in 1953 with routes selected in areas of high dove densities. Between 1957 and 1966, the original routes, which did not provide a representative sample of the dove population, were replaced by randomly selected routes, stratified by physiographic regions (Foote et al. 1958). The survey currently includes more than 1,000 routes. Only randomized routes run since 1966 were included in the analyses for this report. The total number of doves heard on each route is used to determine trends in population size and provides the basis for determining an index to population size during the breeding season. Indices for doves seen are also presented in this report, but only as supplemental information for comparison with doves heard. Even though both the numbers of doves heard and seen are counted during the survey, they are recorded separately.

Within the United States, there are 3 zones which contain mourning dove populations that are largely independent of each other (Kiel 1959). These zones encompass the principal breeding, migration, and U.S. wintering areas for each population. As suggested by Kiel (1959), these 3 areas were established as separate management units in 1960 (Kiel 1961). Since that time, management decisions have been made within the boundaries of the Eastern (EMU), Central (CMU), and Western (WMU) Management Units (Fig. 2).

The Eastern Unit was further divided into 2 groups of states for analyses. States permitting dove hunting were combined into one group and those prohibiting dove hunting into the other. Additionally, some states were grouped to increase sample sizes. Maryland and Delaware were combined; Vermont, New Hampshire, Maine, Massachusetts, Connecticut, and Rhode Island were combined to form a New England group. Due to its small size, Rhode Island, which is a hunting state, was included in this nonhunting group of states for analysis.

In a separate analysis, the WMU and CMU were divided into separate geographic reference areas as adopted by Dunks et al. (1982) and Tomlinson et al. (1988) (Fig. 3). These north-south oriented tiers contain similar dove migration patterns. Separation of states in the EMU was not considered at this time. The reference areas are herein referred to as Coastal WMU, Interior WMU, West CMU, Mid CMU, and East CMU. In this analysis, Nevada was grouped with the interior states of the WMU rather than the coastal states as indicated in the aforementioned publications because of a greater similarity in it's dove populations with the interior states.

METHODS

The Call-Count Survey

Each call-count route is usually located on lightly traveled secondary roads and has 20 listening stations spaced at 1-mile intervals. At each stop, the number of doves heard calling, the number seen, and the level of disturbance (noise) which impairs the observer's

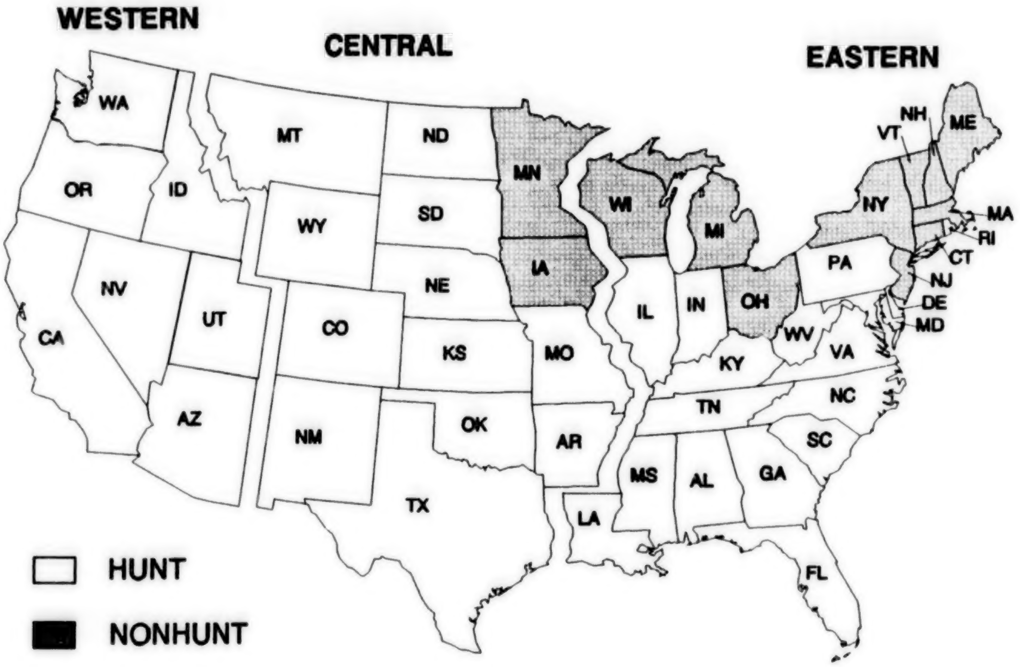

Fig. 2. Mourning dove management units with 1992 hunting and nonhunting states.

ability to hear doves are recorded. The number of doves seen while driving between stops is also noted.

Counts begin one-half hour before sunrise and continue for about 2 hours. Routes are run once between May 20 and June 5. Intensive studies in the eastern United States (Foote and Peters 1952) indicated that dove calling is relatively stable during this period. Surveys are not made when wind velocities exceed 12 miles per hour or when it is raining.

Estimation of Population Trends

A population trend is defined as the ratio of the dove population in an area in one year to the population in the preceding year. For 2-year trends, this ratio is directly estimated from counts; for longer intervals, the ratio is indirectly estimated using linear regression on route data. The trend is expressed as an average annual rate of change. For this report, data were analyzed using the route regression method (Geissler and Sauer 1990). A trend was first estimated for each route using a linear regression on a logarithmic scale. Because many routes have been run by different observers over time, the average trend for each route was estimated with a regression model that considered individual observers and their differing abilities to hear and see doves. The slope is an estimate of the trend of each route and provides a measure of the rate of annual population change in the presence of annual variations or longer term fluctuations in the counts.

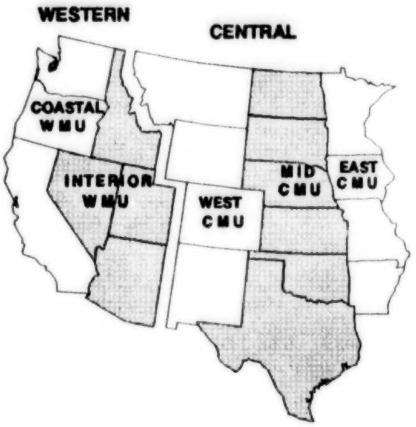

Fig. 3. Geographic reference areas in the Western and Central Management Units.

State and management unit trends were obtained by calculating a mean of all route trends weighted by land area, within-route variance in counts, and density (mean numbers of doves counted on each route). Variances of state and management unit trends were estimated by using route trends and a statistical procedure known as bootstrapping (Geissler and Sauer 1990).

The route regression method was used to estimate the annual change or trend for each area in doves heard over the most recent 2 and 10-year intervals and for the entire 28-year period. Additionally, the trend in doves seen was estimated over the 10 and 28-year periods as supplemental information for comparison. In the WMU, hunting seasons and bag limits were reduced in 1987. In order to determine if the downward population trend has changed since the restrictions were implemented, recent trends in doves heard (1987-93) were compared to pre-restriction trends (1966-86).

For purposes of this report, statistical significance is defined as $P<0.05$, except for the 2-year comparison where $P<0.10$ was used because of the low power of the test. Significance levels are approximate for states with less than 10 routes.

Estimation of Annual Indices

Annual indices show population fluctuations about fitted trends (Sauer and Geissler 1990). The estimated indices were determined for an area (state or management unit) by finding the deviation between observed counts on a route and those predicted on the route from the area trend estimate. These residuals were averaged by year for all routes in the area of interest. To adjust for variation in sampling intensity, residuals were weighted by the land area of the physiographic regions within each state. These weighted average residuals are then added to the fitted trend for the area to produce the annual index of abundance. This method of determining indices superimposes yearly variation in counts on the long-term fitted trend. These indices should provide an accurate representation of the fitted trend for regions that are adequately sampled by survey routes. Additionally, only data from within an area are incorporated into the area's index. Since the indices are adjusted for observer differences and trend, the index for an area may be quite different from the actual count. In order to estimate the percent change from 1992 to 1993, a short term trend (2 years) was calculated. The percent change estimated from this short-term trend analysis is the best estimator of annual change. Attempts to estimate short-term trends from the breeding population indices (which were derived from residuals of the long-term trends) will yield less precise results.

In a separate analysis, the mean number of doves heard calling per route in 1993 was calculated for each state or groups of states. In contrast to the estimated annual index, which illustrates population changes over time, the estimated densities illustrate the actual numbers of doves counted in 1993.

RESULTS

Eastern Management Unit

The Eastern Management Unit includes 27 states comprising 30% of the land area of the United States. Dove hunting is permitted in 17 states, representing 70% of the land area of the unit.

1993 Population Distribution.--Five states had a mean number of 20-30 doves heard per route. These included Indiana, North Carolina, Mississippi, Alabama, and Georgia (Fig. 4). Less than 10 doves per route were heard for Pennsylvania, West Virginia, New England, New Jersey, New York, Maryland/Delaware, Michigan, and Florida.

1992 to 1993 Population Changes.--No significant trend was detected for the EMU. The estimated average number of doves heard per route decreased 3.0%. The population was not significantly different between years in the combined hunting states or the combined nonhunting states, although the index decreased 2.1% in the hunting states and 5.1% in the nonhunting states (Table 1).

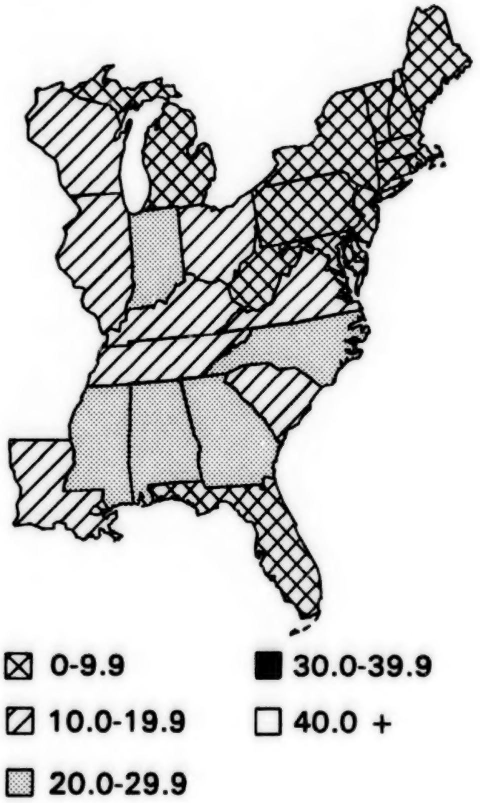

Fig. 4. Mean number of mourning doves heard per route by state in the Eastern Management Unit, 1993.

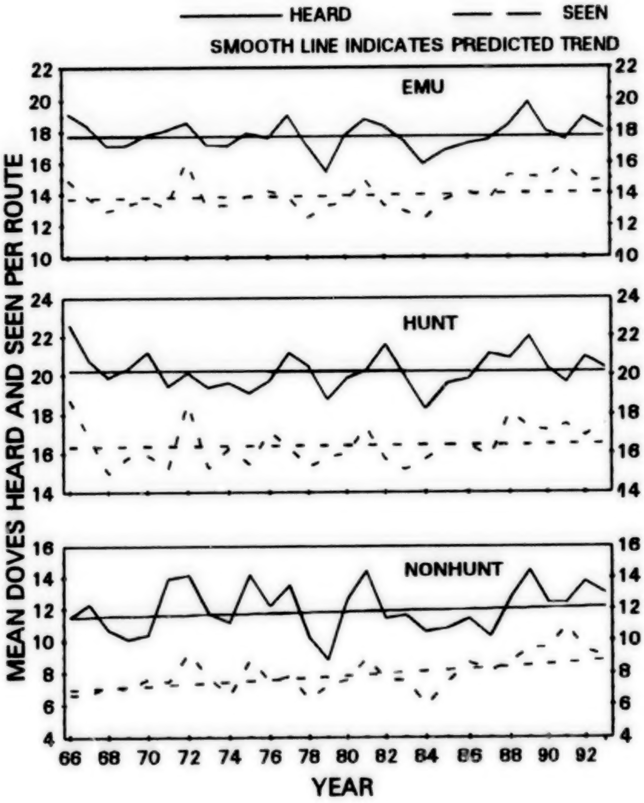

Fig. 5. Population indices of breeding mourning doves in the Eastern Management Unit, 1966-93.

The 1993 population index of 18.2 doves heard per route for the unit was above the predicted count based on the long-term estimate of 17.7 (Fig. 5, Table 2). In the hunting states, the index of 20.4 is slightly above the predicted estimate of 20.2, while in the nonhunting states, the index of 13.0 is above the predicted estimate of 12.1. Indices of doves seen follow the same pattern for the 3 groupings.

The number of doves heard decreased significantly in Florida, Georgia, and Louisiana over the 2-year period (Table 1).

Population Trends: 10 and 28-year.--Analyses indicated no significant trends in numbers of doves heard for the unit or combined hunting states for the last 10 years or the 28-year period between 1966-93 (Table 1). The combined nonhunting states, however, showed no trend over the entire period, but did exhibit a significant increase in numbers heard over the most recent 10 years. A plot of the annual indices both for doves heard and seen shows a similarity in pattern between the 2 counts (Fig. 5).

State population trends for doves heard are shown in Figures 6 (10-year interval) and 7 (28-year interval) and Table 1. A significant increase in numbers was indicated in the New England group of states for both time periods. Delaware/Maryland showed a significant decline over the 28-year period. Wisconsin, Illinois, and Louisiana showed significant increasing trends over the most recent 10 years, whereas significant downward trends were detected in Alabama and South Carolina over the same period.

Central Management Unit

The Central Management Unit consists of 14 states, containing 46% of the land area in the U.S. As in the past, the CMU had the highest population index of the 3 units. Within the Central Unit, dove hunting

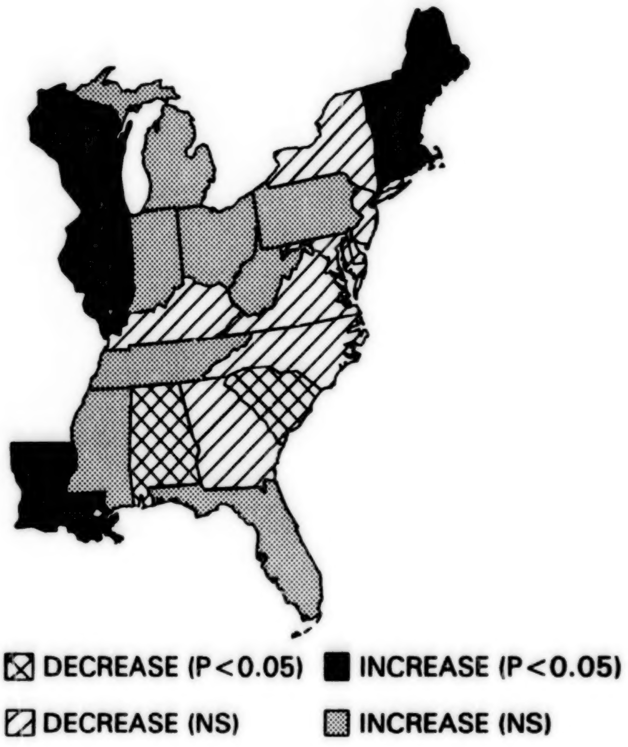

Fig. 6. Trends in number of mourning doves heard per route by state in the Eastern Management Unit, 1984-93.

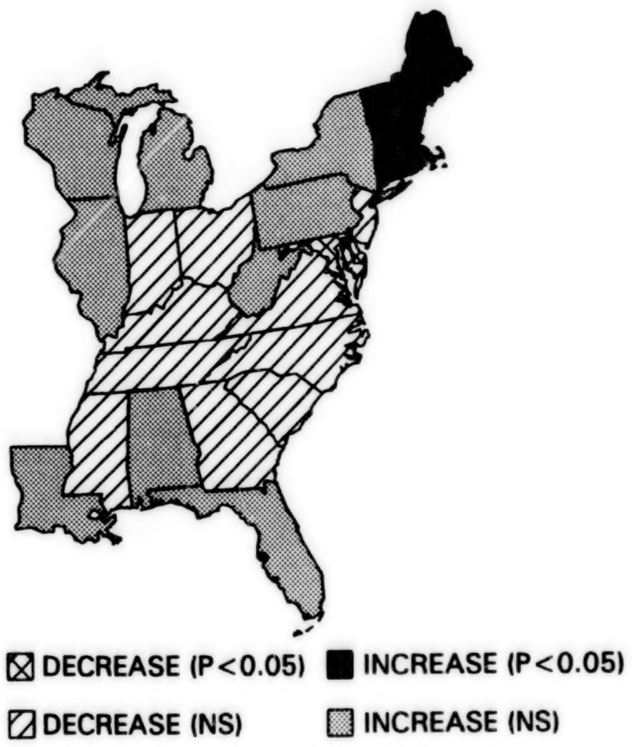

Fig. 7. Trends in number of mourning doves heard per route by state in the Eastern Management Unit, 1966-93.

is permitted in 12 states.

1993 Population Distribution.--North Dakota had the highest average density of doves in the nation with more than 30 doves heard per route (Fig. 8). Montana and Wyoming, averaged less than 10 doves heard per route.

1992 to 1993 Population Changes.--The average number of doves heard per route significantly decreased 6.3% in the CMU (Table 1). Significant declines occurred in Iowa, Kansas and North Dakota. The 1992 index for the unit of 21.1 doves heard per route is below the predicted long-term trend estimate of 23.7 (Fig. 9, Table 2).

In both the West and Mid CMU reference areas, no significant population changes were detected between the 2 years, although the number heard decreased 3.7% and 5.8%, respectively (Table 3). There was a significant decrease of 16.6% in doves heard between 1992 and 1993 in the East CMU.

Population Trends: 10 and 28-year.--No significant trend in doves heard was indicated for the unit over either of the 2 time frames (Table 1). However, for the 10-year period there was a significant increase of 2.0% in doves seen.

In the Mid CMU, no significant trend in doves heard was found for either interval (Table 3). The East CMU population showed a significant downward trend over 28 years, and the West CMU showed a significant decline between 1984-93. Analysis of doves seen for the 3 tiers indicates a significant average yearly decrease of 1.7% for the Eastern CMU over the 28-year period. There was also a significant average yearly increase of 2.3% in doves seen for the Mid CMU for the 10-year period.

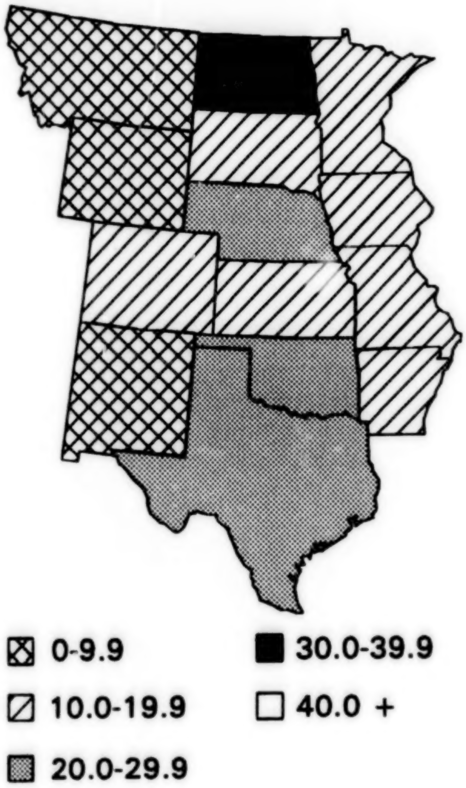

Fig. 8. Mean number of mourning doves heard per route by state in the Central Management unit, 1993.

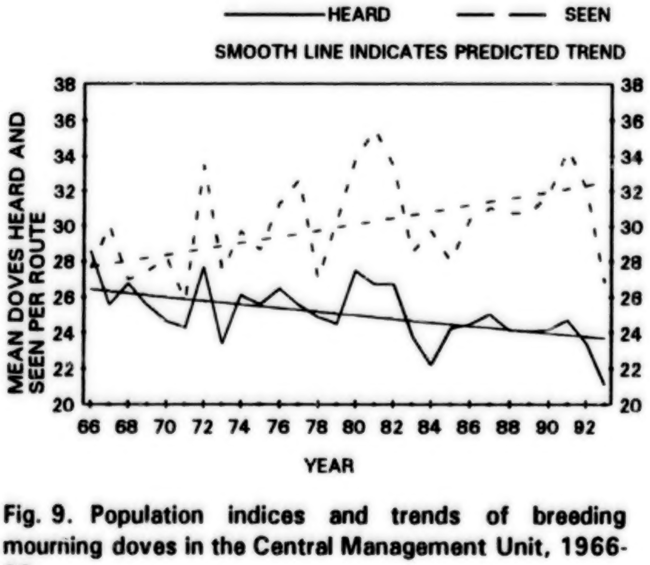

Fig. 9. Population indices and trends of breeding mourning doves in the Central Management Unit, 1966-93.

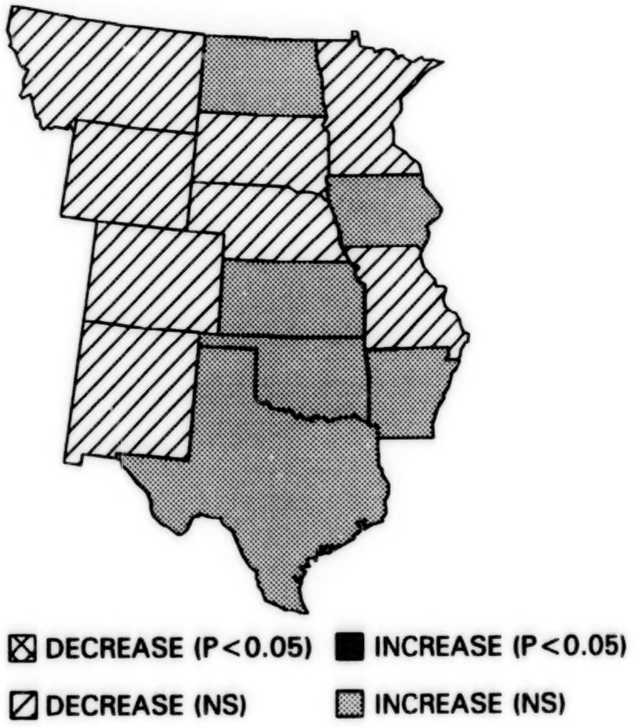

Fig. 10. Trends in number of mourning doves heard per route by state in the Central Management Unit, 1984-93.

State trends in doves heard over 10 years are illustrated in Figure 10 and Table 1. No state showed a significant trend during this time. Figure 11 portrays trends over 28 years. A significant positive trend in the number heard was found in North Dakota, while Missouri and Wyoming showed significant negative trends (Table 1).

Western Management Unit

Seven states comprise the Western Management Unit and represent 24% of the land area in the United States. All states within the unit permit mourning dove hunting.

1993 Population Distribution.--Arizona had an average of more than 20 doves heard per route (Fig. 12). The remainder of the states in the unit averaged less than 10 birds per route.

1992 to 1993 Population Changes.--No significant change in the population was detected for the unit or either of its geographic reference areas (Table 3)

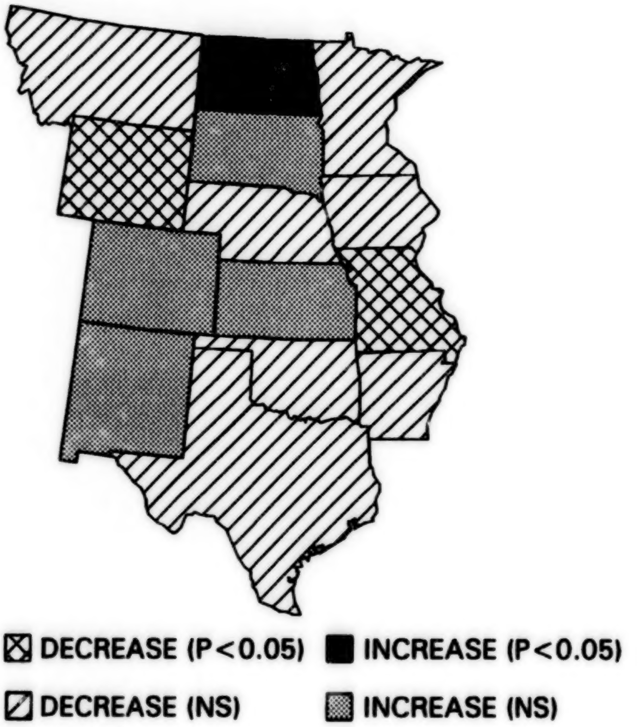

Fig. 11. Trends in number of mourning doves heard per route by state in the Central Management Unit, 1966-93.

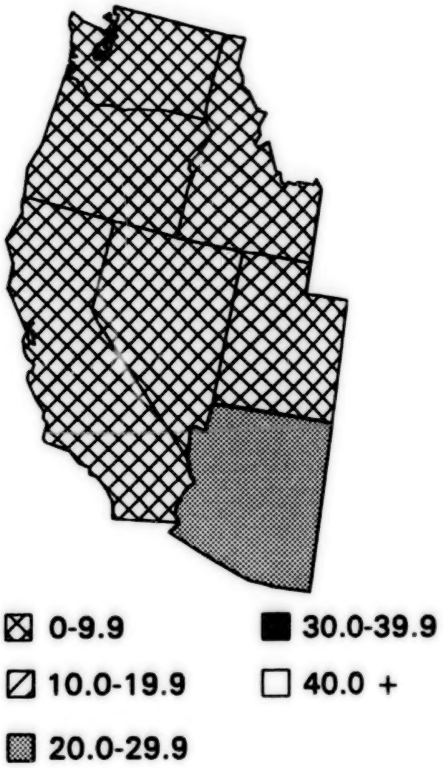

Fig. 12. Mean number of mourning doves heard per route by state in the Western Management unit, 1993.

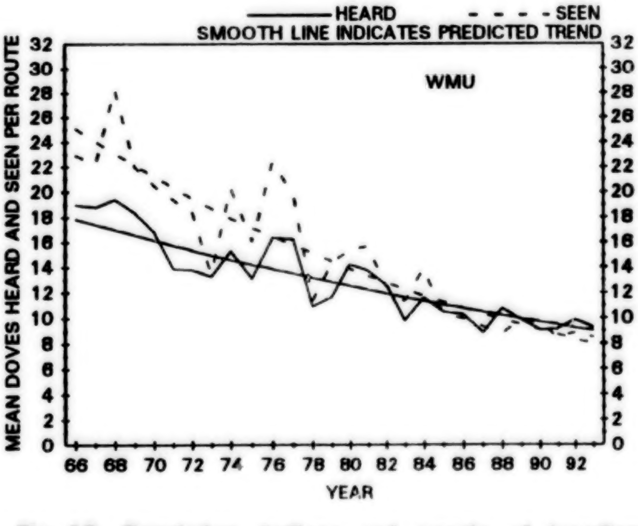

Fig. 13. Population indices and trends of breeding mourning doves in the Western Management Unit, 1966-93.

between 1992 and 1993. The estimated average number of doves heard per route increased by 13.6% (Table 1). The 1993 population index of 9.3 doves heard per route is slightly above the predicted count of 9.0 based on the long-term estimate (Fig. 13).

In Washington and Nevada, the number of doves heard decreased significantly (based on 10 routes, Table 1).

Population Trends: 10 and 28-year.--Estimates indicated significant downward trends in numbers of doves heard for the unit for the 28-year interval, but no significant trend for the last 10 years (Tables 1 and 3). The Coastal WMU showed significant decreases over the 28-year period. The Interior WMU displayed no significant trend in doves heard.

Analyses of doves seen indicated a significant negative trend decline in the WMU (4.0%) and the Coastal subunit (3.4%) over the 10-year period. It also indicated a significant negative trend for the Interior WMU (4.9%) as well as the Coastal WMU (3.4%) for the 28-year period. The indices for doves

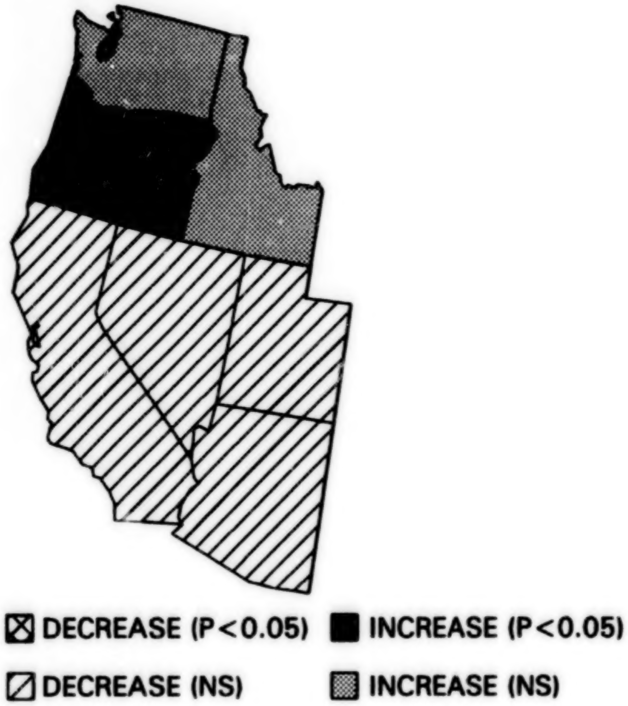

Fig. 14. Trends in number of mourning doves heard per route by state in the Western Management Unit, 1984-93.

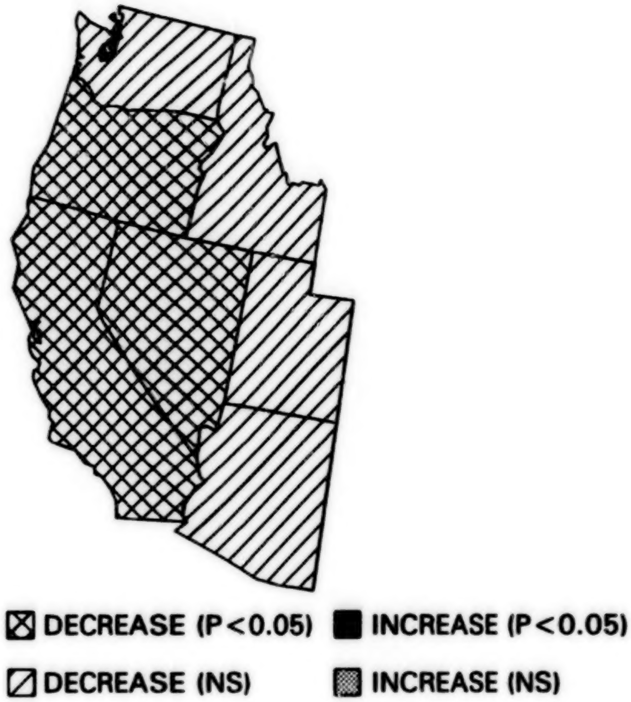

Fig. 15. Trends in number of mourning doves heard per route by state in the Western Management Unit, 1966-93.

heard and seen for the unit have similar patterns from 1966-93 (Fig. 13).

Between 1984 and 1993, a significant upward trend in doves heard was found in Oregon (Fig. 14, Table 1). No state had a significant decline. Over 28 years, significant declines were indicated for Oregon, California, and Nevada (Fig. 15, Table 1).

Population Trends: 7 and 21-year.--Between 1966 and 1986, significant decreasing trends were found in doves heard for the WMU ($P < 0.05$) and the Coastal WMU ($P < 0.01$). In the 7-year period from 1987-93, a significant positive trend was found for the unit (5.2%) and a nonsignificant increase shown for the coastal states. The Interior WMU had a nonsignificant decrease in the 21-year period, but a significant positive trend (7.2%) between 1987 and 1993.

CURRENT ACTIVITIES

New Dove Book Published

The most authoritative and comprehensive book ever compiled on mourning doves has recently been produced by The Wildlife Management Institute. *Ecology and Management of the Mourning Dove* was edited by Thomas Baskett, Mark Sayre, Roy Tomlinson, and Ralph Mirarchi. It has 23 authors, including the editors, and 567 pages. Twenty-nine chapters cover such topics as classification and distribution, migration, nesting, reproductive strategy, growth and maturation, feeding habits, diseases, survey procedures, population trends, care of captive mourning doves, and hunting. Purchase information can be obtained from the publisher, Stackpole Books (800/732-3669).

Management Plans

A mourning dove management plan for the WMU has been completed by the Western Migratory Upland Game Bird Technical Committee. It was formally approved by the Pacific Flyway Council in March, 1992.

Management plans are currently being prepared for the EMU by the Southestern Dove Technical Committee with input from other EMU states, and for the CMU by the Central Migratory Shore and Upland Game Bird Technical Committee.

Eastern Management Unit

Under the direction of Robert Gates and John Roseberry, the Cooperative Wildlife Research Laboratory at Southern Illinois University at Carbondale initiated a study, in cooperation with the Illinois Department of Conservation, to quantify regional and temporal changes in breeding habitat availability and land use patterns along mourning dove call-count routes in Illinois. Habitats and land use are being classified from aerial photographs that cover each of the 20 routes over 3 time periods: 1965-73, 1977-82, and 1988. Habitat distribution will be quantified using indices of landscape structure (i.e., interspersion and juxtaposition of available habitats) along each route. Current status and recent changes (1966-present) in habitat and land use patterns will be examined in relation to breeding population indices and trends derived from the call-count routes in Illinois.

David Otis of the South Carolina Cooperative Research Unit, in cooperation with the South Carolina Wildlife and Marine Resources Department, is directing a banding study designed to estimate seasonal survival rates and movements of local populations in two 300 km^2 study sites in the Piedmont region of South Carolina. The objectives also include an examination of the correlation between significant declines in the South Carolina call-count trends and corresponding changes in agricultural land use. Between July, 1992 and March, 1993, about 600 birds were banded in the two study areas. The direct recovery rate in 1992 was approximately 7%. Thus far, no bird has been recovered more than 20 km from its banding location. It is anticipated that a multi-year study involving intensive band and recovery efforts on a relatively small scale will provide useful demographic information for optimal harvest management in South Carolina

In Alabama, 2 new M.S. level projects on mourning dove molt were initiated in 1992 under the direction of Ralph Mirarchi, Department of Zoology and Wildlife Science, Auburn University. One study is attempting to delineate the exact sequence of body molt in adult mourning doves. The other study is attempting to determine the effects of nutritional restriction on primary feather molt of captive hatching-year mourning doves.

Central Management Unit

The Central Management Unit Migratory Shore and Upland Game Bird Technical Committee initiated a pilot study in 1989 evaluating potential techniques for future research on the role of hunting in mourning dove population dynamics. Field work on this pilot study by the Missouri Department of Conservation began in the spring of 1990 and continued until the fall of 1992 with the final report now scheduled to be completed by July 1994.

Preliminary data analyses revealed a highly skewed and fluctuating sex ratio. Beginning in the fall of 1993, currently accepted techniques which estimate mourning dove age and sex will be evaluated by a select group of mourning dove biologists. Study results suggest that presently available transmitter/battery packages, the limited ability to monitor radio-marked doves, and low recapture frequencies preclude the use of telemetry for estimating annual survival rates.

Western Management Unit

Michael R. Miller of the Dixon, California Field Station of Northern Prairie Wildlife Research Center (USFWS) is in the second of a 2-year mourning dove nesting study at several sites in California to estimate nesting density and productivity by habitat type, and to document changes in productivity since the 1950's and 1970's. The California Department of Fish and Game (CDFG) is supporting the project this year by funding field crews.

Dan Yparraguirre and Patty Forbes (CDFG) are conducting a pilot study that suggests that declines in California dove numbers can be related to habitat changes. Valley/blue oak woodland and agricultural habitats (primarily small grain crops) appear to be the predominate habitats negatively affected, whereas grasslands have increased in area.

Sam Blankenship (CDFG) has re-initiated banding activities and hopes to band 4,000 birds per year during the preseason period between 1993 and 1997. In 1993, 5 banding areas will be established. Doves from each banding area will be tested for trichomoniasis to determine the incidence of this disease.

In Utah, 2 studies are in progress under the direction of Mike Conover (Department of Fisheries and Wildlife, Utah State University) and John Bissonette (Utah Cooperative Fish and Wildlife Research Unit) to better understand why mourning dove populations are declining in Utah and the WMU. The studies will investigate changes in population ecology related to long-term changes in habitat over the last 40 years.

ACKNOWLEDGMENTS

Personnel of state wildlife agencies and the U.S. Fish and Wildlife Service cooperated in collecting the data presented in this report. J.R. Sauer developed the computer programs used to analyze the data. P.D. Keywood performed computer processing services. M.A. McKeogh provided secretarial support. G.W. Smith reviewed the manuscript and provided helpful comments and suggestions.

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Table 1. Trends (% change[a] per year as determined by linear regression) in number of mourning doves heard along call-count survey routes, 1966-93.

	2 year (1992-93)					10 year (1984-93)					28 year (1966-93)				
	N	% Change		95% CI		N	% Change		95% CI		N	% Change		95% CI	
EASTERN UNIT															
Hunt															
AL	27	10.0		-11.6	32.7	32	-2.5	**[b]	-5.0	-0.1	42	0.5		-0.9	2.0
DE/MD	8	-11.3		-39.7	15.8	16	-0.5		-4.4	3.0	19	-2.4	**	-4.5	-0.1
FL	20	-23.0	***	-33.4	-12.6	24	1.7		-1.6	5.1	30	1.8	*	-0.1	3.7
GA	19	-25.2	***	-39.8	-10.2	24	-0.9		-3.4	1.8	28	0.0		-1.3	1.2
IL	10	6.7		-1.6	16.8	21	4.9	***	2.3	7.8	22	1.7		-0.4	3.6
IN	13	-6.8		-29.2	18.6	16	2.2	*	-0.2	5.0	18	-1.6	*	-3.1	0.0
KY	14	1.9		-22.5	29.9	19	-0.2		-4.3	4.1	25	-1.3		-4.4	1.5
LA	16	-27.3	***	-44.7	-7.6	20	5.0	**	0.2	9.3	23	0.7		-1.2	2.7
MS	20	19.4		-23.7	72.8	27	2.0		-4.5	8.3	30	-0.6		-4.2	3.3
NC	21	3.8		-12.3	21.3	24	-1.1		-3.3	1.5	24	-1.4		-3.3	0.6
PA	11	7.9		-19.8	38.8	17	1.8		-2.6	6.2	17	1.2		-1.6	3.7
SC	20	-17.7		-41.1	6.6	22	-3.0	**	-5.8	-0.4	25	-0.9		-3.4	1.4
TN	19	1.8		-28.2	34.3	25	0.2		-2.5	3.1	31	-1.6	*	-3.5	0.3
VA	26	4.6		-9.0	19.3	33	-3.5	*	-7.3	0.2	33	-2.5	*	-5.3	0.2
WV	9	1.5		-32.1	48.0	10	3.1		-2.7	10.2	11	3.8		-1.7	7.7
Subunit	253	-2.1		-9.7	6.1	330	0.8		-0.9	2.5	378	0.0		-1.2	1.2
Nonhunt															
MI	14	-7.2		-30.9	18.5	20	0.9		-3.3	5.0	20	0.4		-3.5	4.2
N.ENGLAND[c]	33	7.7		-7.6	23.7	64	4.6	***	2.0	7.3	77	2.9	***	1.0	4.8
NJ	8	67.2		-34.7	177.4	12	-0.1		-2.8	2.2	20	-2.5		-5.8	1.2
NY	12	-5.7		-27.3	18.9	18	-1.5		-5.5	3.3	20	1.0		-2.3	4.9
OH	14	-11.8		-30.0	6.3	19	1.9		-1.5	5.7	55	-0.9		-2.7	0.8
WI	12	-9.3		-34.0	16.5	22	10.6	***	7.9	13.6	22	1.8	*	-0.1	3.8
Subunit	93	-5.1		-15.6	5.3	155	3.4	***	1.3	5.5	214	0.2		-1.4	1.8
Unit	346	-3.0		-9.5	3.9	465	1.3	*	-0.2	2.8	592	0.0		-1.1	1.1
CENTRAL UNIT															
AR	12	-5.6		-28.9	18.9	15	4.6	*	-0.4	11.2	16	-1.3		-4.9	1.9
CO	12	-5.8		-29.8	19.6	16	-3.6		-10.0	3.1	19	1.7		-1.2	4.3
IA	7	-22.8	**	-39.3	-3.5	16	2.7		-1.5	6.6	17	-0.6		-1.8	0.9
KS	21	-30.0	***	-42.1	-17.9	26	0.5		-2.5	3.5	31	0.2		-1.3	1.5
MN	7	-16.0		-67.4	40.7	13	-0.4		-4.4	3.7	14	-0.7		-3.3	2.6
MO	15	-11.3		-32.6	11.9	20	-1.8		-5.3	1.5	26	-3.6	***	-5.5	-2.1
MT	12	-11.4		-51.0	26.3	24	-1.5		-3.7	1.0	28	-2.4		-5.2	0.6
NE	18	-2.0		-19.9	18.5	26	-0.5		-3.1	2.1	27	-0.6		-1.9	0.8
NM	23	11.6		-17.0	41.2	29	-5.6	*	-11.9	0.1	31	4.3	*	-0.5	9.1
ND	19	-21.7	*	-43.9	1.7	28	2.9		-2.1	7.3	29	2.9	**	0.4	5.3
OK	15	-12.3		-31.4	12.0	21	0.7		-5.2	6.4	24	-2.7		-6.1	1.4
SD	11	-14.1		-35.6	9.0	21	-1.6		-7.0	3.6	27	0.9		-1.5	3.1
TX	99	-0.1		-10.2	10.4	141	1.9		-0.6	4.7	191	-0.1		-1.3	1.1
WY	6	1.9		-46.5	50.5	17	-0.2		-6.9	6.6	19	-2.8	**	-5.2	-0.1
Unit	277	-6.3	*	-13.1	0.4	413	0.9		-0.8	2.7	499	-0.4		-1.4	0.6
WESTERN UNIT															
AZ	27	28.4		-8.3	68.1	57	-0.3		-2.8	2.4	67	-1.0		-2.9	0.8
CA	40	2.2		-29.2	36.0	58	-1.3		-4.0	1.5	74	-3.9	***	-6.3	-1.5
ID	10	18.8		-8.9	59.7	21	5.3	*	-0.1	11.2	23	-1.4		-5.3	2.3
NV	8	-28.5	*	-57.4	4.3	18	-1.0		-9.5	7.6	27	-4.5	**	-7.9	-0.7
OR	14	14.7		-17.5	46.3	21	5.1	**	0.1	10.1	23	-2.2	**	-4.3	-0.4
UT	11	-7.1		-41.2	31.4	15	-2.5		-7.9	5.0	16	-3.0		-8.2	1.2
WA	10	-48.7	***	-77.4	-13.0	19	0.6		-4.2	5.4	22	-3.0	*	-6.2	0.5
Unit	120	13.6		-8.5	36.6	209	-0.4		-2.3	1.5	252	-2.5	***	-4.0	-1.0

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[a] Mean of route trends weighted by land area and population density. The estimated count in the next year is (%/100+1) times the count in the current year where % is the annual change. Note: Extrapolating the estimated trend statistic (% change per year) over time (e.g., 28 years) may exaggerate the total change over the period.

[b] *P<0.1; **P<0.05; ***P<0.01.

[c] New England consists of CT, ME, MA, NH, RI, and VT. Note: RI is a hunt state; included due to small sample size.

Table 2. Breeding population indices[a] based on mourning doves heard along call-count routes, 1966-93.

Management unit/state	Year													
	1966	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	1979
EASTERN UNIT														
Hunt														
AL	23.7	21.4	19.3	19.7	19.9	16.4	23.5	20.7	16.0	20.7	20.0	22.1	24.5	23.9
DE/MD	17.8	21.6	15.1	15.9	19.7	16.7	18.0	17.8	18.5	13.1	15.7	14.5	14.9	14.4
FL	9.3	8.9	7.6	8.6	10.3	8.7	9.3	9.6	12.1	13.1	12.0	13.2	10.5	11.4
GA	27.5	26.4	22.9	24.6	31.1	24.6	23.9	26.5	28.1	30.6	24.1	25.4	27.9	24.6
IL	20.7	18.1	21.5	18.8	22.3	20.4	21.1	21.1	18.0	26.2	25.9	27.9	22.1	19.2
IN	37.0	34.2	33.6	32.4	31.3	42.2	36.9	33.0	31.4	33.0	33.1	37.6	20.4	21.6
KY	29.5	26.5	24.9	24.5	31.1	27.8	23.4	27.7	31.4	21.9	27.0	25.2	26.6	18.3
LA	11.1	11.4	10.6	12.4	7.6	11.1	12.2	9.4	11.0	11.4	11.4	9.4	11.0	9.3
MS	35.6	30.8	26.2	24.4	27.6	28.5	31.7	28.6	23.6	25.8	26.4	27.5	31.7	27.4
NC	38.2	30.8	32.4	44.4	51.1	29.6	24.0	45.5	25.8	14.5	17.5	42.9	22.8	27.0
PA	8.8	9.7	8.9	8.6	5.5	6.4	8.9	5.8	8.6	6.0	6.2	4.9	6.0	6.9
SC	32.7	35.7	36.7	35.3	33.3	29.1	26.0	29.6	27.6	27.3	27.1	23.0	30.6	26.0
TN	31.6	23.0	23.5	23.2	31.6	22.3	28.3	21.5	23.0	21.9	21.6	23.7	29.2	20.0
VA	26.1	21.4	24.5	21.6	27.7	22.1	13.3	15.6	21.1	23.6	22.4	29.8	22.0	19.5
WV	5.1	4.3	4.5	4.9	4.8	4.5	6.1	3.6	3.9	2.2	5.5	5.2	6.6	7.3
Subunit	22.6	20.8	19.9	20.3	21.2	19.4	20.1	19.4	19.6	19.1	19.7	21.1	20.4	18.8
Nonhunt														
MI	12.3	13.3	8.8	9.0	7.3	14.4	15.0	11.9	10.1	11.3	11.5	10.0	11.5	6.7
N.ENGLAND[b]	5.1	5.3	4.7	4.5	5.3	5.5	6.2	7.4	4.8	4.7	4.5	8.3	7.3	6.3
NJ	19.1	16.3	20.3	18.6	25.2	23.7	24.9	22.0	20.2	14.5	18.2	19.9	15.8	16.9
NY	6.9	6.9	6.5	6.1	7.9	9.1	7.2	7.5	7.6	13.4	8.0	8.0	9.7	6.5
OH	22.1	20.9	18.9	21.5	21.2	22.1	23.0	18.3	22.4	34.3	25.1	24.1	12.6	12.3
WI	9.3	12.1	12.1	9.3	10.2	14.9	15.5	10.6	11.2	14.4	14.6	19.5	8.1	11.8
Subunit	11.5	12.3	10.7	10.1	10.4	13.9	14.1	11.7	11.1	14.2	12.2	13.5	10.2	8.8
Unit	19.2	18.4	17.1	17.1	17.7	18.1	18.6	17.2	17.1	17.9	17.6	19.0	17.1	15.4
CENTRAL UNIT														
AR	23.9	24.8	23.9	22.7	24.5	24.4	22.9	25.7	23.6	22.5	27.3	22.2	15.7	12.8
CO	16.3	16.9	15.7	21.5	22.1	16.1	21.6	14.1	22.7	17.0	24.0	23.1	26.0	22.2
IA	32.2	28.8	31.2	27.7	20.0	24.6	31.9	30.2	23.6	21.8	27.3	21.2	23.7	20.2
KS	45.5	47.4	49.2	49.8	45.9	46.7	52.2	46.8	46.5	44.4	49.2	46.8	36.6	53.6
MN	23.0	18.8	23.5	17.5	14.2	20.4	23.5	17.9	24.5	27.0	24.3	33.0	26.7	27.1
MO	46.0	43.3	53.3	31.4	43.3	35.9	48.2	35.8	30.3	34.4	29.9	34.5	22.0	20.6
MT	27.2	25.1	19.6	21.4	17.2	24.0	19.1	13.7	15.9	21.5	15.8	18.6	18.0	17.7
NE	42.9	37.7	48.2	47.2	45.7	43.7	42.7	41.0	42.3	39.9	44.9	45.7	37.8	40.5
NM	10.8	7.6	11.2	8.7	8.6	8.3	9.9	7.3	9.3	12.3	12.4	11.4	11.9	8.4
ND	27.2	27.1	36.8	30.9	28.1	29.9	31.0	35.9	36.9	28.0	45.7	38.5	42.9	41.2
OK	27.9	34.4	40.2	38.2	30.0	19.9	30.7	28.7	29.3	26.2	28.0	34.3	26.0	24.5
SD	44.6	28.2	38.7	33.4	40.6	37.1	36.9	39.3	47.7	40.3	43.6	39.6	43.3	43.3
TX	25.7	20.5	20.8	19.0	20.1	19.2	25.8	21.5	22.5	20.5	19.9	19.0	19.8	24.6
WY	18.2	19.1	10.1	16.3	15.7	8.9	12.2	12.2	17.5	15.5	14.4	9.1	14.8	11.5
Unit	28.6	25.6	26.7	25.5	24.6	24.3	27.7	23.4	26.1	25.6	26.4	25.5	24.9	24.5
WESTERN UNIT														
AZ	28.8	29.1	26.1	30.7	30.8	20.5	23.2	28.1	24.2	26.7	27.6	24.6	24.7	25.6
CA	30.1	28.2	26.3	25.3	24.8	18.2	21.8	20.4	21.8	18.3	21.8	16.4	14.6	11.1
ID	14.5	15.0	13.7	14.8	13.8	11.1	10.7	13.0	11.3	7.9	14.6	18.2	10.2	9.9
NV	8.6	7.1	16.7	12.0	8.6	5.4	6.6	4.6	7.1	4.2	7.1	7.2	4.4	6.4
OR	14.5	9.7	11.5	10.4	7.9	7.0	6.8	6.8	11.9	9.0	9.4	10.6	5.6	5.8
UT	17.9	27.5	14.1	13.4	15.3	21.4	12.5	10.9	12.4	13.5	15.9	18.6	8.2	10.2
WA	9.1	13.3	12.4	9.8	10.0	11.7	8.4	7.5	9.3	9.9	9.5	10.4	6.6	9.3
Unit	19.0	18.8	19.4	18.4	16.8	13.9	13.8	13.3	15.3	13.1	16.4	16.2	10.9	11.7

Table 2. Continued.

Management unit/state	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
EASTERN UNIT														
Hunt														
AL	24.1	23.7	24.6	25.0	21.0	26.9	24.6	22.3	24.6	21.2	20.1	18.8	21.4	23.4
DE/MD	13.7	13.0	13.5	9.8	11.1	12.1	13.8	11.6	10.9	14.6	6.9	10.4	13.3	8.9
FL	9.2	9.1	10.8	12.6	8.7	11.3	13.3	12.1	14.6	13.1	11.7	12.8	14.0	12.5
GA	25.4	28.1	30.3	27.1	22.6	28.2	25.6	26.4	26.6	27.5	28.0	23.0	32.3	20.3
IL	19.9	22.6	27.7	28.9	23.4	20.2	28.0	27.3	32.0	31.2	29.9	31.2	32.6	30.3
IN	27.4	31.7	22.6	19.4	21.1	18.5	24.7	24.8	29.8	25.2	27.2	27.5	24.3	25.8
KY	17.7	29.7	25.8	13.9	22.3	22.9	20.6	25.0	19.8	26.5	22.0	21.5	17.0	21.7
LA	12.9	11.3	14.1	12.8	12.3	11.0	10.0	14.3	10.9	17.7	12.7	12.5	16.6	12.8
MS	25.7	25.9	32.5	27.3	20.8	27.5	27.1	24.1	28.7	27.3	23.3	18.7	23.8	28.0
NC	26.2	25.6	21.3	25.1	28.0	19.5	27.1	25.9	23.0	27.6	25.9	22.1	21.3	22.1
PA	8.3	9.4	8.9	9.0	8.6	9.2	9.8	11.1	7.6	10.0	10.0	10.1	11.5	12.1
SC	32.7	31.9	33.0	31.4	28.5	28.6	24.1	35.4	28.0	26.9	29.2	23.6	23.2	27.6
TN	21.8	18.4	24.6	19.1	16.3	21.0	16.1	19.8	19.4	18.0	15.8	18.9	18.5	17.3
VA	19.2	16.4	18.0	17.7	17.2	15.9	12.9	13.6	15.0	14.8	13.2	14.1	12.1	13.8
WV	8.4	6.8	6.6	6.3	5.9	7.3	7.0	7.4	8.7	9.0	11.9	9.9	8.0	9.1
Subunit	19.8	20.2	21.6	20.0	18.3	19.6	19.3	21.1	20.9	22.0	20.4	19.6	20.9	20.4
Nonhunt														
MI	12.4	14.2	10.2	9.0	9.8	10.8	13.9	11.3	13.7	17.2	12.8	10.4	11.3	10.5
N.ENGLAND[b]	7.8	9.6	7.8	8.3	7.3	8.2	9.0	8.7	8.1	8.5	9.5	10.4	11.1	11.3
NJ	15.4	13.4	15.1	17.9	11.3	12.1	14.3	13.1	12.7	15.7	12.1	12.8	8.8	14.5
NY	11.3	9.7	10.3	9.5	9.1	8.3	7.0	8.8	7.2	11.0	9.6	11.8	10.8	10.7
OH	14.9	18.2	17.3	18.3	17.3	16.0	15.7	16.8	19.4	18.1	16.4	17.5	18.3	16.4
WI	15.5	21.2	12.2	14.7	11.6	12.0	13.1	8.7	20.5	20.6	16.5	15.3	23.6	20.1
Subunit	12.6	14.4	11.4	11.6	10.5	10.8	11.4	10.3	12.6	14.4	12.4	12.4	13.8	13.0
Unit	17.8	18.7	18.3	17.4	15.9	16.8	17.2	17.5	18.4	19.9	18.0	17.5	18.9	18.2
CENTRAL UNIT														
AR	21.1	23.0	26.7	20.3	14.6	14.3	15.5	14.5	16.3	22.7	18.1	16.3	19.7	18.5
CO	26.2	30.2	29.4	16.7	21.4	26.1	25.5	28.0	31.4	35.7	32.3	22.0	16.8	16.9
IA	27.2	29.9	21.6	16.7	21.9	24.2	21.9	21.3	28.3	26.0	30.7	23.6	30.6	27.0
KS	58.3	55.5	53.0	59.6	47.3	61.9	42.3	46.0	53.2	47.5	41.6	58.8	57.6	39.2
MN	29.8	26.4	23.2	20.9	17.8	19.6	18.4	23.5	23.9	19.9	16.1	20.1	23.9	17.7
MO	31.4	25.9	22.8	21.9	20.4	19.5	20.3	22.8	22.7	22.7	18.1	18.5	17.7	16.9
MT	16.1	15.0	19.0	15.1	11.2	14.9	15.3	13.8	11.7	15.0	15.1	11.4	11.3	9.8
NE	51.7	49.0	48.2	44.0	41.9	43.2	35.4	35.3	35.4	38.7	38.5	39.4	37.0	38.2
NM	14.3	14.3	11.4	16.0	17.8	15.7	19.1	24.0	18.6	20.7	24.2	22.0	14.8	16.9
ND	47.2	48.6	46.0	45.0	36.2	48.3	47.3	55.3	52.8	56.5	55.6	62.1	62.6	54.5
OK	24.8	24.3	25.0	25.9	19.2	18.6	20.3	21.4	19.3	13.9	18.2	18.1	19.6	16.9
SD	43.8	40.1	47.7	42.9	47.5	44.6	41.8	36.9	43.7	48.8	51.5	52.3	45.5	40.8
TX	23.6	21.6	21.1	19.6	19.3	20.0	21.7	21.4	21.9	16.9	18.6	25.1	22.3	19.6
WY	10.3	11.4	14.7	9.9	8.9	10.5	12.9	10.4	6.8	8.0	8.1	8.5	9.1	7.8
Unit	27.5	26.7	26.7	23.8	22.2	24.2	24.5	25.0	24.1	24.1	24.2	24.7	23.4	21.1
WESTERN UNIT														
AZ	21.6	24.3	27.9	21.7	26.7	21.5	25.2	17.0	19.0	23.0	17.8	21.6	23.8	23.8
CA	18.7	15.0	18.6	11.6	15.8	11.0	12.7	9.4	12.4	9.2	9.0	9.1	9.9	11.8
ID	10.5	11.6	12.0	9.5	11.1	10.3	7.3	7.5	10.1	10.1	11.0	10.4	8.7	8.2
NV	9.2	6.5	3.6	3.2	3.2	4.3	2.8	3.3	4.2	4.0	2.7	3.5	2.9	2.5
OR	8.7	7.5	7.4	5.6	7.1	7.8	6.2	5.7	7.3	5.9	6.7	4.1	6.7	5.4
UT	12.2	16.3	9.8	9.9	11.4	7.5	10.4	9.2	9.6	9.9	8.9	7.7	10.7	9.2
WA	6.2	7.4	6.9	5.8	5.0	6.2	7.7	6.0	6.0	5.3	5.5	6.8	5.9	4.3
Unit	14.2	13.8	12.6	9.8	11.6	10.5	10.3	8.9	10.8	9.9	9.1	9.2	9.9	9.3

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[a] Annual indices are defined as the predicted value from the trend analysis plus the deviation from the expected value in a year. A large, but not significant change based upon a small sample size will produce exaggerated indices over the 28-year period.

[b] New England consists of CT, ME, MA, NH, RI, AND VT. Note: RI is a hunt state; included due to small sample size.

Table 3. Trends(% change[a] per year as determined by linear regression) in number of mourning doves heard along call-count survey routes, 1966-93.

Geographic reference area	2 year (1992-93)					10 year (1984-93)					28 year (1966-93)				
	N	% Change		95% CI		N	% Change		95% CI		N	% Change		95% CI	
CENTRAL UNIT															
West CMU[b]	53	-3.7		-20.5	13.6	86	-2.9	**[c]	-5.3	-0.5	97	0.1		-2.1	2.4
Mid CMU[d]	183	-5.8		-13.6	2.6	263	1.2		-0.6	3.2	329	-0.2		-1.2	0.9
East CMU[e]	41	-16.6	**	-30.8	-1.4	64	0.6		-1.5	2.8	73	-1.4	***	-2.5	-0.4
Unit[f]	277	-6.3	*	-13.1	0.4	413	0.9		-0.8	2.7	499	-0.4		-1.4	0.6
WESTERN UNIT															
Coastal WMU[g]	64	-4.2		-29.3	23.5	98	-0.9		-3.3	1.6	119	-3.6	***	-5.8	-1.6
Interior WMU[h]	56	17.6		-12.1	49.4	111	-0.2		-2.5	2.2	133	-1.6	*	-3.3	0.1
Unit[f]	120	13.6		-8.5	36.6	209	-0.4		-2.3	1.5	252	-2.5	***	-4.0	-1.0

[a] Mean of route trends weighted by land area and population density. The estimated count in the next year is (%/100+1) times the count in the current year where % is the annual change. Note: Extrapolating the estimated trend statistic (% change per year) over time (e.g., 28 years) may exaggerate the total change over the period.

[b] West CMU: MT, WY, CO, and NM.

[c] *P<0.1; **P<0.05; ***P<0.01.

[d] Mid CMU: ND, SD, NE, KS, OK, and TX.

[e] East CMU: MN, IA, MO, and AR.

[f] These data are also presented in Table 1, but are included here to facilitate comparison.

[g] Coastal WMU: WA, OR, and CA.

[h] Interior WMU: ID, NV, UT, and AZ.